

Study and determination of meat products quality

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Abstract

In this paper the goal is to analyze from the point of view of quality, different meat products from the market, frequently consumed, like pate, summer salami and bologna. Thus, it was determined the content of protein, of collagen, the content of NaCl and the humidity. All the analysis results obtained is compared with the requirements of Order 210 from 31 August 2006 on the marketing of meat products. The analysis results for the sample of bologna, show 1.1% more humidity in product than the maximum allowed, and collagen/protein ratio is exceed by 10.9 compared to the maximum. Analysis results for pate, framing the standards required by legislation currently in force, compared to analytical results obtained for sample summer salami. The latter has a higher humidity content with 7.8%, exceeding the maximum, also collagen/protein ratio is double the maximum allowed value, namely 40.49.

Keywords: collagen, meat quality, hydroxyproline, humidity, salt content

1. Introduction

Controlled Consumer choice is influenced by the composition of the products. In the case of meat products should detected possible fraud, because in production, the higher quality meat may be substituted by adding collagen in products. It is made to increase the protein content and water binding property. This significantly lowers the quality, but the total content is limited[1].

Production of various meat products have provided poultry meat parts which are suitable for being mechanically deboned, due to its consistency and low cost often used in bologna [2]. Due to mechanical deboning process, proteins are denaturated by breaking the cells, leading to an increase in lipid, with negative consequences on the color, flavor and perishability [3,4].

Some products contains tendons, beef shank or mechanically separated bones from beef, pork and

poultry carcasses [5]. Meat products may involve substitution of meat from a high value with meat from a lower value, with connective tissue, fat and the use of non-meat proteins or other substances [6].

The collagen has low biological value due to deficiency of lysine, tryptophan and sulphur amino acids. Determining the quantity of collagen is the simplest way to assess the quality of protein in the product [7]. In food industry gelatine and denatured collagen are used as stabilizers and thickeners [8]. Collagen is a major component of protein, that contains the amino acid hydroxyproline Hyp [9]. Collagen in the connective tissue contains on average 12.5% hydroxyproline, compared to 1% containing the proteins from composition of muscle tissue and elastin [10]. The determination of amount of hydroxyproline, in different meat parts can specify the quantity of collagen in meat and meat products [11]. The quality characteristics determine consumer perception of meat products and are affected in this

case, by the raw materials used [12]. In recent years, consumers are concerned of the products authenticity. Analytical methods used in authentication are very diverse: for additions of non-meat constituent such as water and inclusive for detected proteins, because cheap animal protein are used like fraudulent substitution [13].

For this reason in this paper is intended to analyze from the point of view of quality, meat products, in terms of determination of collagen / protein ratio, but also the humidity and NaCl for additional verification of these parameters, quality factors. NaCl is used as a preservative, inhibiting the development of microbial spoilage flora, but high salt intake produces cardiovascular disease [14]. Sodium influence the metabolism of water, stimulate myoneural activities and high intake of sodium, increase the renal excretion of calcium [15]. The addition of water in food products is source of dispute and a method of fraud.

2. Materials and Method

Were used the meat products, commonly consumed, purchased from the supermarket: pate, summer salami and bologna. Samples were kept at 4°C, closed hermetic until analysis.

Humidity content determination using infrared radiation was made at thermobalance, SR ISO 1442:2010 and salt content determination was made by Mohr's method.

Protein determination was performed by the Kjeldahl method, using mineralization installation DK 6 and distillation installation UDK 127 by Velp Scientifica. Protein content was performed in order to make then collagen / protein ratio, values which are found in the Order 210 of 2006 for each product on the market.

Hydroxyproline content was determined by method describe in SR ISO 3496:1997, for each product.

Method was carried out with some modifications. 2 grams of each sample was hydrolyzed by boiling with 30 mL 6N HCl, at 85°C for 8 h. The hydrolyzate is passed quantitatively into a 500 mL volumetric flask, is added 5 ml chloroform and water up to the mark, then was filtered. 10 mL hydrolyzate is diluted at 250 mL and 4 mL diluted

was mixed with 2 ml oxidativ solution cloramine T, previously prepared in an aqueous buffer solution containing 0,35 grams cloramine T, 5 mL distilled water, 20 ml buffer solution (pH 6.8). Is homogenise, is let at rest 20 minutes and add the 2 ml of color reagent 4-dimethyl-amino-benzaldehyde (20 g of para-dimethyl-benzaldehyde in 22 ml perchloric acid, and then 3 ml are diluted with 16 ml of propyl alcohol), is shaken and afterwards put in water bath at 60 °C for 15 min. After cooling the solution allow to stand 30 minutes, after then is measured the extinction on spectrophotometer T80 UV/VIS, at wavelength 560 nm. Extinction is directly proportional to the concentration of hydroxyproline and using regression equation calculated the quantity of hydroxyproline of the samples.

Results are calculated compared to a reference standard of known concentration. In place of the standard solution hydroxyproline was used pork skin. Pork skin was used to achieve a benchmark scale, considering that has 22,4% collagen and 1,79% hydroxyproline and solution was obtained in a similar way with the samples, but at quantity of 1 gram. The collagen was calculated by multiplying the hydroxyproline content by 12,5 and then is calculated the ratio collagen / protein compared to standards [16,17].

3. Results and discussions

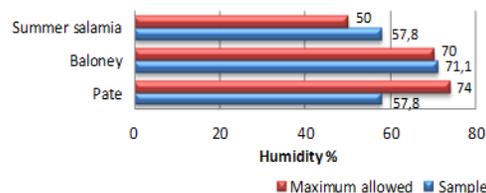


Figure 1. Determination of humidity content

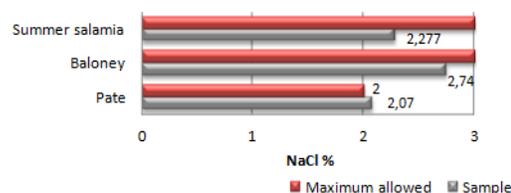


Figure 2. Determination of sodium chloride content

Analysis results obtained are compared with the requirements of Order 210 from 31 August 2006. As shown by Figure 1. the percentage of humidity from two samples exceeded the allowed limit, because results for salami show 57,8% moisture and legislation accepts only 50%. Analysis results indicate for bologna 71,1% humidity and legislation 70%, only the pate are framing in limit, having 57,8 % humidity as against maximum of 74%.

In Figure 2. it can be seen that values for sodium chloride content, are framing the norms for all the three products, although the sample of pate has 2,07 % NaCl compared with maximum 2 %, may be considered insignificant value. For summer salamia and bologna, maximum is 3% NaCl and the results indicate 2,277 %, respectively 2,74% sodium chloride content.

In literature are found many wavelengths to which is doing the reading at spectrophotometer: 557 nm [18], 558 nm [19], 558 ± 2 nm (SR ISO 3496:1997), 560 nm (AOAC, 2000) [20], 590 nm [21]. For these reason, for hydrolysed sample with pork skin were made dilutions. Solution: water ratio is 3:1, 1:1, 1:3. Were traced the spectral curves for diluted and undiluted solution. It can be seen in Figure 3. that the absorbance for standard solutions is maximum at 560 nm wavelength, which was subsequently used to determine the collagen content of meat samples.

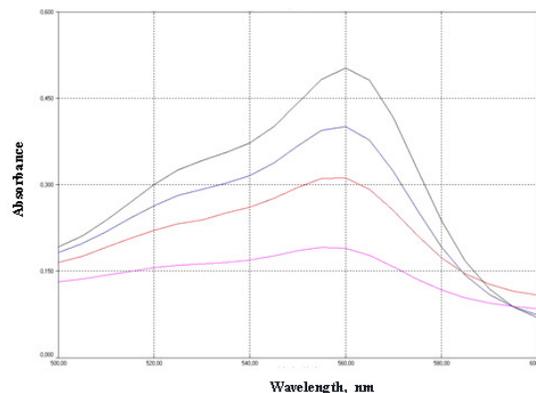


Figure 3. From top to bottom, absorption spectra for: undiluted solution, diluted 3:1, diluted 1:1, diluted 1:3.

To calculate the content of collagen in samples, for standard solution of hydroxyproline diluted 3:1, the absorbances obtained at 560 nm was 0,17; for solution diluted 3:1 absorbance was 0,228; for solution diluted 1:3 absorbance was 0,38 and for solution undiluted, absorbance was 0,432. Formula is: % Collagen=100/12.5*Hyp and pork skin has 22,4% collagen and 1,79% hydroxyproline according Labelling and Composition of Meat Products – Guidance Notes. Because dilutions were made, concentration in collagen and hydroxyproline is becoming smaller with the dilution increase, thus that between absorbance and concentration of hydroxyproline there is a direct proportionality. Thus, has resulting regression equation with correlation coefficient $R^2=0,9686$, Figure 4.

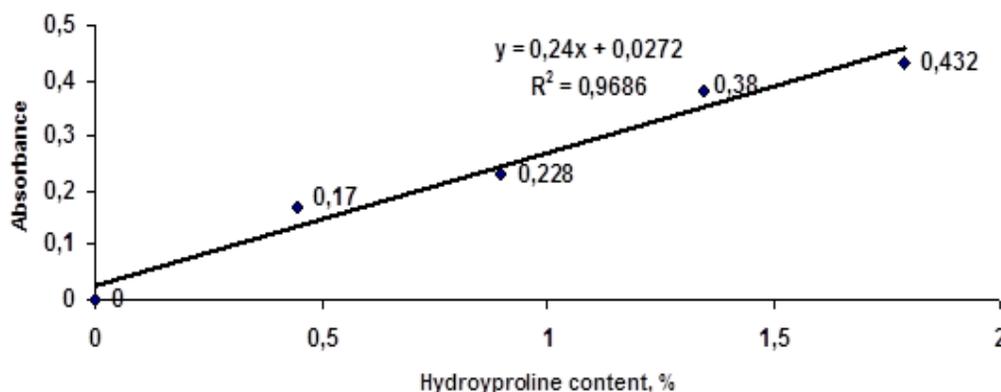


Figure 4. Calibration graph for the spectrophotometric determination of Hyp

Table 1. The quantity of hydroxyproline in the samples analyzed.

Product	Absorbance	Hidroxyproline [%]
Pate	0,052	0,1032
Bologna	0,117	0,374
Summer salami	0,103	0,3157

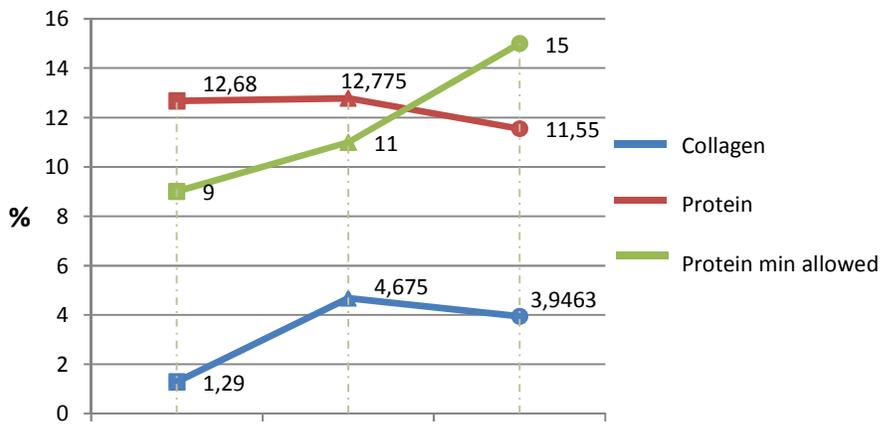


Figure 5. The percentage of collagen and protein from samples and the minimum amount of protein allowed by legislation.

Absorbances obtained at 560 nm, for the three samples was 0,117 for summer salami; 0,103 for bologna and 0,052 for pate. Subsequently using the equation $y=0,24x + 0,0272$, was calculated the amount of hydroxyproline of the samples (Table 1).

Through calculation, knowing the quantity of hydroxyproline in samples, was used to determine the amount of collagen in formula: $\%Collagen = 100/12.5 * Hyp$ (Labelling and Composition of Meat Products – Guidance Notes).

In Figure 5. are represented results of the analyzes for the three samples. For pate is shown collagen content of 1,29% and 12,68% protein. Minimum protein content according to legislation is 9%, it results that the product is framing current regulations. For bologna, collagen content obtained is 4.675%, 12.775% protein, and minimum protein content allowed is 11%. The product from this point of view, respect the standards. For summer salami sample, collagen content obtained by analyzing is 3.9463%, 11.55% protein content, while minimum content of protein

that it should have according to the legislation is 15%. This result indicates that the salami contains a small amount of protein compared to the allowed.

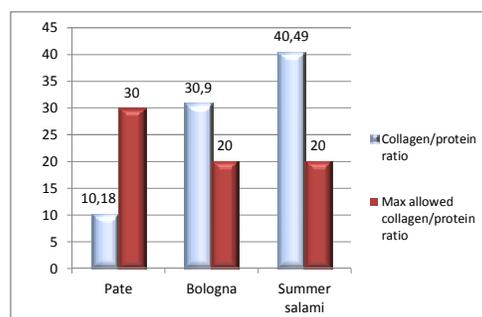


Figure 6. The collagen/protein ratio for samples and maximum collagen/protein ratio allowed by legislation

It can make a comparison between the three products. Is noting in the graph of Figure 6, the fact that highest collagen content is in bologna, followed by salami and pate. The pate sample and the bologna sample have a close protein content, respectively 12.68% and 12.775%, ranked last being the salami with only 11,55%.

Is seen from the Figure 6. as for samples of bologna and summer salami, the values obtained from the analyzes exceed the maximum collagen / protein ratio from the Order 210/2006.

From the experimental data pate has the ratio 10,18 and its maxim is 30. Bologna exceeds by 54,5% the maximum, having ratio 30,9 compared to the limit 20. And also for the sample of salami the ratio obtained is much higher: 40,49 in comparison with the limit 20. This indicates a greater amount of collagen used in the products.

Conclusion

The determination of collagen content in meat products is important from a legislative and nutritive point of view. The results of the analyzes for the samples of summer salami and bologna, are not within the rules imposed by Order No. 210 from 2006. The percentage of humidity from samples exceeded the allowed limit, respectively at salami with 7,8% over 50% and at bologna with 1,1% over 70%, pate having only 57,8 % moisture compared to the limit 70%. Values for sodium chloride content, are framing the norms for all the three products. From the experimental data result that summer salami has a lower content of protein with 3,45% than the minimum allowed 15%. The other samples, normally exceeding the limit for minimum protein content, with 1,77% for bologna and 3,68% for pate. Value of collagen / protein ratio for bologna is with 10,9 much higher and for summer salami with 20,49 double the maximum allowed value.

Samples of bologna and summer salami contain more water, and the collagen / protein ratio is too high. In conclusion, this reflects meat preparations nutritionally unbalanced, using in their manufacture, connective tissues, which are not listed on the label. Exceeding these limits of humidity, favors the accentuation of perishability, affect the quality and not least, affect economy. Consumer buy "water", instead of meat.

It requires a closer supervision and monitoring, to ensure the quality of meat and the more extended analyzes at more samples.

Compliance with Ethics Requirements. Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human / or animal subjects (if exist) respect the specific regulation and standards.

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